

GORDON TECH HIGH SCHOOL

CURRICULUM GUIDE

Course Title: Precalculus
Department of: Mathematics

COURSE DESCRIPTION: The student will study the fundamentals of advanced algebra and trigonometry necessary to meet the challenges of calculus.

COURSE GOALS / OBJECTIVES: The student will:

- use tables and graphs as tools to interpret expressions, equations, and inequalities
- operate on expressions, and solve equations and inequalities
- use instructional technology to provide meaningful visual representations of pre-calculus concepts
- communicate pre-calculus notions verbally and in writing
- apply pre-calculus notions and problem-solving techniques to explore real-life applications
- read and interpret written presentations of pre-calculus ideas with understanding
- translate among tabular, symbolic, and graphical representations of functions
- analyze the effects of parameter changes on the graphs of functions
- solve trigonometric equations and verify trigonometric identities

COURSE OUTLINE:

Unit 1: Review of Elementary Algebraic Concepts

- perform basic operations with pairs of real numbers
- simplify a numerical expression using the rules for order of operations
- evaluate an algebraic expression using the rules for order of operations
- simplify and evaluate an expression containing positive and negative exponents
- rewrite an expression by using the distributive property
- simplify an expression involving opposites and absolute values

Unit 2: Solving Equations

- solve an equation by using properties of equality
- solve an equation with the variable on both sides
- solve an equation that contains parentheses
- solve an equation that contains fractions
- solve an equation that contains decimals
- solve an equation that contains absolute value

Unit 3: Linear Inequalities

- find and graph the solution set of an inequality by using properties of inequality
- find and graph the solution set of a conjunction and a disjunction of inequalities
- find and graph the solution set of an inequality containing absolute value

Unit 4: The Coordinate Plane

- graph a relation and determine its domain and range
- determine a relation from its graph
- determine whether a relation is a function
- find values of a function described by an equation
- graph a linear equation using a table of x -values and y -values
- find the slope of a line, given two of its points
- write an equation of a line, given a point on the line and its slope
- write an equation of a line, given two points on the line
- write an equation of a line, given a table or graph
- write an equation of a line, given its slope and y -intercept
- find the slope and y -intercept of a line, given its equation
- graph a line using its slope and y -intercept
- graph a line using both of its intercepts
- determine whether a given point lies on a given line
- determine whether two lines are parallel, perpendicular
- graph a linear inequality in two variables

Unit 5: Systems of Linear Equations and Inequalities

- solve a system of two linear equations in two variables by graphing
- solve a system of two linear equations in two variables using the substitution method
- solve a system of two linear equations in two variables using the linear combination method
- solve a system of three linear equations in three variables
- solve a system of two linear inequalities in two variables by graphing

Unit 6: Polynomials

- simplify an expression containing positive integral exponents
- simplify an expression containing negative integral exponents
- simplify the sum or difference of polynomials
- multiply polynomials
- factor out the greatest common monomial factor from a polynomial
- factor a trinomial into the product of two binomials
- simplify the sum or difference of polynomials
- multiply polynomials

- factor out the greatest common monomial factor from a polynomial
- factor a trinomial into the product of two binomials
- factor the difference of two squares
- factor a perfect-square trinomial
- factor a polynomial completely
- factor a polynomial by grouping pairs of terms
- factor the sum or difference of two cubes
- divide a polynomial in one variable by a binomial using the method of long division

Unit 7: Higher-Degree Equations and Inequalities

- solve an equation of degree 2, 3, or 4 for its rational roots by factoring
- find and graph the solution set of a second-degree or third-degree inequality in one variable
- divide a polynomial $P(x)$ by $x - a$ using synthetic division
- evaluate a polynomial using synthetic substitution
- determine whether a binomial $x - a$ is a factor of a polynomial $P(x)$
- find the rational zeros of an integral polynomial
- factor an integral polynomial into first-degree factors
- find the rational roots of an integral polynomial equation of degree greater than

2

Unit 8: Rational Expressions

- find the domain of a rational function
- find the zero of a rational function
- simplify and evaluate a rational expression
- multiply and divide rational expressions
- add and subtract rational expressions
- simplify a complex rational expression
- solve an equation containing rational expressions

Unit 9: Radical and Rational Exponents

- find the square root of a positive number
- find the domain of a function involving square roots
- simplify an expression containing the sum or difference of square roots
- simplify an expression containing the product or quotient of square roots
- simplify a radical with index greater than 2
- write an expression with rational exponents in radical form, and vice versa
- simplify an expression containing rational exponents
- add and subtract expressions containing radicals
- multiply and simplify expressions containing radicals
- divide and simplify expressions containing radicals

- solve an equation containing rational exponents

Unit 10: Complex Numbers

- solve an equation of the form $x^2 = k$, where $k < 0$
- find the sum or difference of complex numbers
- find the absolute value of a complex number
- simplify the product or quotient of complex numbers
- raise a complex number to an integral power
- solve a quadratic equation for its complex roots by completing the square
- solve a quadratic equation for its complex roots by using the quadratic formula
- find the three cube roots of a nonzero integer which is a perfect cube

Unit 11: Polynomial Equations and Functions

- find the sum and product of the roots of a given quadratic equation without solving the equation
- write a quadratic equation in general form given its roots
- describe the nature of the roots of a quadratic equation by finding its discriminant
- solve a radical equation
- find all the roots of an integral polynomial equation
- graph an integral polynomial function of degree n with n distinct real zeros
- find the remaining zeros of integral polynomials given one nonreal zero

Unit 12: Coordinate Geometry and Quadratic Functions

- find the distance between two points
- find the midpoint of a segment
- graph an equation of the form $y - k = a | x - h |$
- graph a parabola of the form $y - k = a (x - h)^2$
- change an equation of a parabola from general form to standard form
- determine the vertex and axis of symmetry of a parabola described by an equation in standard form or in general form

Unit 13: Introduction to Right-Triangle Trigonometry

- compute the sine, cosine, tangent, cosecant, secant, and cotangent of an acute angle of a right triangle
- use a trigonometric table to find a trigonometric ratio of an acute angle of a right triangle
- find missing measures of sides and angles of right triangles using trigonometric ratios
- solve word problems using trigonometric ratios
- determine the quadrant containing the terminal side of an angle of rotation

- find the measure of an angle coterminal with a given angle
- find the six trigonometric ratios of an angle given the coordinates of a point on the terminal side of the angle
- find the six trigonometric ratios of an angle of any measure
- find the six trigonometric ratios of an angle of rotation whose reference angle measures 30, 45, or 60 degrees
- evaluate an expression involving a trigonometric ratio
- find all angle measures between 0 and 360 degrees corresponding to a given trigonometric ratio
- find all possible trigonometric ratios given the value of one trigonometric ratio and the sign of another

Unit 14: Solving Triangles

- use the Law of Cosines to find the length of a side or the measure of an angle of a triangle
- solve a word problem using the Law of Cosines
- find the area of a triangle given the lengths of any two sides and the sine of the included angle
- find the area of a triangle given the lengths of its three sides using Heron's

Formula

- find the area of a regular polygon
- find a length of a side of a triangle using the Law of Sines
- solve a word problem using the Law of Sines
- solve a triangle using the Law of Sines, given the measures of two sides and a nonincluded angle
- determine whether one, two, or no triangles can be constructed given the measures of two sides and a nonincluded angle
- use the Law of Sines and the Law of Cosines to solve a triangle

Unit 15: Graphing Functions

- convert radian measure to degree measure and vice versa
- find trigonometric ratios for a given radian angle measure
- determine whether a periodic function is odd, even, or neither
- graph a periodic function
- determine the amplitude of a periodic function
- graph the sine and cosine functions for a given domain
- determine $\sin(-x)$ and $\cos(-x)$ for given values of $\sin x$ and $\cos x$
- graph a function of the form $F = a \sin b(x + c) + d$ or $F = a \cos(x + c) + d$
- determine the amplitude, the period, and the maximum and minimum values of a function of the form $F = a \sin b(x + c) + d$ or $F = a \cos(x + c) + d$
- graph the tangent, cotangent, secant, and cosecant functions
- determine the inverse of a trigonometric function
- evaluate an expression involving trigonometric inverse functions
- graph the six trigonometric inverse functions

Unit 16: Trigonometric Identities and Equations

- verify a fundamental trigonometric identity for given values of the variables
- prove a fundamental trigonometric identity
- simplify a simple trigonometric expression
- prove a trigonometric identity using a fundamental trigonometric identity
- solve a trigonometric equation involving one trigonometric ratio
- solve a trigonometric equation using trigonometric identities
- prove a trigonometric identity using sum and difference identities
- simplify a trigonometric expression using double-angle and half-angle identities
- prove a trigonometric identity using double-angle and half-angle identities
- solve a trigonometric equation involving multiple angles

ACTIVITIES:

Small groups of students will work as a team to share ideas, solve problems, and justify conclusions.

Students will use manipulatives to help them to grasp abstract concepts on a concrete level.

Assessments:

Homework assignments

Test and quizzes

Portfolios, which may contain results of works such as these:

open-ended questions, problems, and tasks: The student discusses in writing a mathematical situation, formulates hypotheses, makes generalizations, and so on;

research projects: The student uses resources outside the classroom in order to complete a long-term project;

journal entries: The student keeps written entries detailing such things as the methods used in solving a particularly difficult or interesting problem, or reflections and reactions about specific assignments or class activities;

cooperative learning activities: The student writes a summary of the work accomplished;

demonstrations: Students working individually, in pairs, or in groups demonstrate ideas using manipulatives, graph paper, compasses, calculators, or computers;

investigations: The student keeps a log which includes the date, a description of the work done, and questions the student has for the teacher. The teacher's response to the questions is recorded in the log;

models and simulations: The student writes a summary which describes the activity and includes relevant diagrams, sketches, and photographs;

non-routine problems: The student restates the problem in his own words, explores the problem by drawing a picture or a chart, chooses a strategy such as guess and test, look for a pattern, logical deduction, working backward, or exhaustive listing, and carries out the chosen strategy to solve the problem;

interviews: The student talks while the teacher listens and asks questions regarding the learner's thought processes as related to specific problems;

time-staggered samples: The student collects work samples dealing with the same mathematical idea completed at different times during the year;

Error notebooks: students keep a list of specific homework, test, and quiz problems that resulted in errors. A three-column format might include a statement of the problem as posed, a statement of the exact error made, and a correction and comment.

SPECIFIC EXAMPLES OF ASSESSMENT ITEMS:

Given a quadratic relation, find its vertex, its intercepts, its axis of symmetry, and draw its graph. Demonstrate the techniques of completing the square and of using the quadratic formula in order to locate the zeros. Explain each step as you perform it.

Compare the method of adding or subtracting real numbers with that of complex numbers. In what ways are the methods of multiplication and division different for these sets of numbers?

Use one or more of the fundamental trigonometric relationships to verify a given identity. Describe your general strategy, and identify the relationships used at each stage of the process.